

and some are to be seen until the end of October. Twenty-eight eggs, some fresh, others more or less incubated, were brought to me from the mountains, north of Chinwangtao, on the 25th of June, 1917, and a clutch of three, slightly incubated, from the same locality on the 2nd of July following. I saw on the 16th of September, 1915, numbers travelling along the sea-shore, hovering and feeding on the dunes as they passed by.

181. *Cerchneis tinnunculus japonicus* (T. & S.).

*Falco tinnunculus* D. & O. p. 36 (part).

*Cerchneis japonicus* La T. p. 578.

The Japanese Kestrel passes in spring and in September and October. A few winter in the vicinity. Some breed in the mountains to the north of Chinwangtao. A clutch of four slightly incubated eggs was brought to me with the female on the 3rd of May, 1917.

[To be continued.]

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XXXIV.—*Some preliminary remarks on the Altitude of the Migratory Flight of Birds, with special reference to the Palearctic Region.* By Col. R. MEINERTZHAGEN, D.S.O., M.B.O.U., F.Z.S.

A GREAT deal has been written on this little-known subject, but in nearly all cases theories have been advanced which have been supported by unsatisfactory evidence, or by evidence of a very scanty nature.

Let us see what evidence is available.

Gietke affirms that the altitude of migratory flight under normal conditions is so great as to be completely beyond the powers of human observation, whilst he regards such portions of it as are brought within our notice as disturbances and irregularities of the migratory movement. In other words, he considers visible migration to be abnormal and invisible

migration to be normal. Gaetke is careful to explain that by normal migration he only means those large extensive movements which carry birds in one uninterrupted, and for the most part nocturnal flight, from their starting point to their destination. He further considers that the height of normal migration is at least 20,000 feet. It must be remembered that Gaetke's observations were confined to Heligoland, and that he occasionally allows his enthusiasm to outrun his facts, but this does not in the least lessen the charm of his delightful book.

Whitlock (*'Migration of Birds,'* 1897, pp. 56-88) challenges Gaetke's statements and notes the unsatisfactory evidence on which his theories are based. But sound theories can be arrived at by conviction if based on a wide experience, even though such theories cannot be scientifically proved. Gaetke's theory is non-proven, but is based on experience such as no other ornithologist can claim. Whitlock gives us no evidence to enable us to arrive at the truth, though he produces much destructive criticism.

Now let us turn to some very definite evidence. On October 19, 1880, at Princeton in New Jersey, W. E. D. Scott (*Bull. Nuttall Ornith. Club*, vi. pp. 97-100) saw large numbers of birds passing across the face of the moon, when observing through an astronomical telescope. It was estimated that these birds were at an altitude of between 5000 and 10,000 feet. On April 16, 1881, further observations were made at the same place, but only some low-flying Swallows were seen on the northward passage.

Chapman (*Auk*, 1888, pp. 37-39), also in New Jersey, watching for nearly three hours on the evening of Sept. 3, 1887, observed 262 birds cross the face of the moon. Of these, 233 were estimated to be at a height of from 1500 to 15,100 feet. It was observed that the lower-flying birds seemed to be flying upwards and were seeking "the proper elevation at which to continue their flight." Among the birds recognised were five Carolina Rails, of which three

were thought to have been between 1900 and 10,200 feet, one between 2000 and 11,000 feet, and one between 2600 and 13,500 feet.

In 1905, Carpenter (Auk, 1906, pp. 210-217) conducted some experiments by night in May and October, with a view to observing birds passing the face of the moon. In May no bird was observed flying at over 2400 feet, the lowest flying at 1200 feet. In October birds ranged from 1400 to 5400 feet.

Lucanus, who appears to be much interested in this subject, finds (J. f. O. 1902, pp. 1-9) that migrants generally travel at under 3300 feet above the earth and always below the lowest clouds. A very high altitude is unnecessary for birds, because, according to aerial observations, the perspective disappears at over about 3300 feet. Again (J. f. O. 1913, pp. 117-124) he finds from observations made from German air-ships, that the flight of birds is very seldom at altitudes of over 1200 feet, whilst no birds have hitherto been detected at an elevation exceeding 3000 feet.

The following is an important scrap of evidence from India. Donald (Journal Bombay Nat. Hist. Soc. xxv. 1917, p. 302), when in the Himalaya at 14,000 feet above sea-level, observed "Storks and Cranes" flying in a north-easterly direction at the end of May. They were not visible to the naked eye, and could only with difficulty be seen through glasses. Now I have seen Geese at an altitude of over 4000 feet. They were difficult to pick up, but once seen were easily followed with the naked eye. If Donald's Cranes were invisible to the naked eye, they must have been at least 6000 feet above ground level.

Evidence from British Lighthouses is all too meagre. At the Tuscar Rock, Patten ('Zoologist,' 1913, p. 182) estimated Pipits to fly at 70 feet above the sea, Swallows between 40 and 100 feet, and Wagtails at about 120 feet. At the Eddy-stone, Eagle-Clarke (Ibis, 1902, pp. 246-269) estimated Meadow-Pipits to fly at about 20 feet above the sea, and Wagtails between 130 and 200 feet.

Ingram (Ibis, 1919, pp. 321-325) gives the following

evidence as a result of interrogating some five or six hundred pilots of the Royal Air Force between 1916 and 1918, all records being from north-eastern France.

Lapwings.—14 records between 2000 and 8500 feet, the majority between 5000 and 6000 feet. In flocks on both passages, the earliest spring record being on I. ii. and the earliest autumn record being on 15. vii.

Lapwings.—26. ii. 17 at 6000 feet, flying at 50 m.p.h. air speed against a strong N. wind, when the surface wind was south.

Geese or Duck.	26. xi. 15.	3000 feet.	Flock of 500.	Wind N.N.E. at 50 m.p.h., birds travelling due S.
Geese.	.....	9000		
		8000		
		3000		
Cranes ?	August.	15,000	2 birds.	
Crane ?	4 April.	8000	1 bird.	
Linnets ?	22. viii. 15.	10,000	A flock.	
Rooks.	March 1917.	6000	50 birds.	
Rook ?	10. vii. 18.	3000	Flying S.W.	
Starlings.	?	3500		
Fieldfares ?	March 1917.	3500		
Sandpipers.	March 1917.	12,000	Flying east.	
Waders.	?	10,000		
Waders.	18th. Dec.	9500	Flying south.	
Whimbrel.	Early March.	4000	Flying N.E.	
Hérons.	?	3000		

Before I received a copy of this number of 'The Ibis,' I had already put an advertisement in 'The Times' asking pilots for any notes on this subject. All pilots agreed that birds were seldom seen at over 2000 feet or so, and that if birds were observed it was a noteworthy phenomenon. Also that if birds had been about they would most certainly have been spotted by the trained observers watching for hostile aircraft. The results are given overleaf, but, as was to be expected, I received many replies of the following nature. "On April 1st I was surprised to meet 40 cock Ostriches at 17,000 feet. I attacked them at once and broke up the formation. One nose-dived on to the General's tent whilst another crashed into our cook-house."

The saner correspondents gave me the following details:—

<i>Species.</i>	<i>Date.</i>	<i>Height</i>	<i>Place.</i>	<i>Remarks.</i>
		feet.		
Lapwing.	9. iii. 18.	6500	N.E. France.	Flying north.
Duck.	11.45 A.M. 26. xi. 15.	7500	N.E. France.	Flock of 8-10 fly- ing south in a snowstorm.
Rooks.	An evening. in May 1916.	11,000	Salisbury.	Flock of 60-70 flying S.E.
Kestrel.	Jan. 1916.	7000	Birmingham.	Single bird.
Golden Plover.	10.30 A.M. 25. xii. 16.	6600	Gallipoli.	Flock of 14 flying E.S.E. Clear day with slight W.S.W. wind.
Lapwing.	1. x. 17.	8000	Eastbourne.	Flock of 400 going S.S.W.
Geese.	Feb. 1917.	700	Firth of Forth.	
Gannets.	?	?	Eastbourne.	Thousands going in an easterly direction at below 1000 feet.
Lammergeier.	20. iii. 18.	11,000	N.E. Italy.	Single bird.
Plover.	21. xii. 16.	1400	N.E. France.	Two lots of 15 flying due north. There was a con- tinuous layer of cloud from 700- 1200 feet.
Pigeon?	10.30 A.M. 11. iii. 17.	8000	N.E. France.	Flock of 25.
Birds sp. inc.	11 A.M. 15. viii. 18.	10,500	N.E. France.	Flock of 20.

In addition to the above, Capt. Wynne, writing to me in December 1918 notes the remarkable lack of bird-life at over 1000 feet when observing from an aeroplane, though he was constantly on the look-out for birds when flying. He only met birds at over 1000 feet on two occasions, and knew of two cases where Geese had been seen at 6000 feet in France by our pilots, but could not give further detail.

The following information was given to me by two officers who flew for two years in Mesopotamia. Swifts were seen at 6000 feet over Mosul in July, but were not on passage. White Storks were seen migrating in April at 4200 feet over Baghdad, and Geese and Duck were frequently met with soon after dawn passing north on spring migration, but usually between 2000 and 3000 feet.

I also glean the following notes from the 'Field.' Plover (Field, 22. ix. 17) were met with at 6000 feet on 6. ix. in N.E. France, flying north with a 25 m.p.h. wind from the south. Again on 5. iii. Capt. Portal (Field, 17. iii. 17) saw a large flock of Lapwing at 5000 feet flying due north. The ground wind was 5 m.p.h. from the south, but at 3000 feet and over it was north-west and blowing 30 m.p.h., whilst at 5000 feet it was nearly due north.

My own observations from the air are confined to a solitary instance, though I frequently flew in both Palestine and East Africa when migration was in full swing. It occurred in early April at about 7 A.M. in East Africa, when at 5200 feet over the southern slopes of Kilimanjaro we encountered a large scattered flock of Lesser Kestrels and Bee-eaters (*Merops apiaster*), making their way north against a slight head wind. The day was one of those perfect African mornings, and the sun shining on the brilliant hues of these birds wending their way north to their nurseries, against the glistening snows of Kilimanjaro, was one of those scenes never to be forgotten.

During the recent war I was able to make the following observations on diurnal migration, in each case the height of flight being obtained by the use of theodolites on a wide base.

*British East Africa.*

Red-throated Pipits.	210 feet.
Wagtails.	160-240 feet.
Swallows.	210, 235, and 240 feet.
Rollers.	720, 840, 850, and 860 feet.
Kestrels.	150-310 feet.
Caspian Plover.	480, 490, 830 feet.

(All taken in the early morning in clear still weather on autumn passage.)

*Southern Palestine.*

Pelicans. 1240 feet. A clear still October afternoon, birds travelling south-west.

*North-west France.*

Rooks. (3 cases) 1740, 2008, and 2120 feet, all taken on still evenings in late October. Birds flying west.

Rooks and Jackdaws. 690 feet. Flock of over 200 mixed birds flying west on a clear evening.

Green Plover. 1410, 4346, 6210, and 6870 feet. All in flocks and flying south-west soon after daylight in early October. Weather calm and clear.

Geese. 4240 feet. A skein of 17 flying west by south on a clear frosty November evening just before sunset.

Hooded Crows. Observed passing along the coast near Boulogne, never over 300 feet up. Weather dull but sometimes clear.

All passage of Larks, Finches, and Buntings was observed at only a few feet above the ground.

Finally, I give a few scraps of evidence culled from various sources.

*Rooks*. High flyers over Heligoland. (Gaetke.)

*Hooded Crows*. Low flyers over Heligoland. (Gaetke.)

*Skylarks*. Heligoland. They pass between 1000–2000 feet in clear weather, and at 200 feet in damp dull weather. (Gaetke.)

*Richard's Pipit*. Their migratory flight is high when passing Heligoland. (Gaetke.)

*Pericrocotus cinereus*. Southern China. They fly high when travelling. (Ibis, 1913, p. 36.)

*Song-Thrush*. Heligoland. They fly high in clear weather, but low in damp dull weather. (Gaetke.)

At Jericho on a dull November morning with clouds as low as 200 feet, I watched hundreds dropping like stones into a banana plantation soon after daylight. They came *through* the cloud and not from below it.

*Hedge-Sparrow*. They migrate at 200 feet in Heligoland. (Gaetke.)

*Wren*. Patten (Irish Nat. 1912, p. 125) thought they were low flyers on migration.

*Hoopoe*. Several seen arriving off the coast of southern Palestine, flying but a few inches above the sea when about 10 miles from land.

*Rollers.* Port Said. Individuals seen arriving and descending from a height. (Lynes.)

*Sparrow-Hawk.* They travel at a great height over Heligoland. (Gaetke.)

At Jerusalem I watched Sparrow-Hawks continuing their spring passage in 1920. They would soar up to some 1500 feet or so, and then make off in a northerly direction in the clear still evenings just before sunset.

*Honey Buzzard.* They travel at a great height over Heligoland. (Gaetke.)

This is confirmed by Irby's observations at Gibraltar, though they travel low in bad weather.

*White Stork.* Akaba, Sinai. Seen passing north on spring passage at 300 feet (Zedlitz, J. f. O. 1912, p. 337).

On 6. iii. I saw many large flights of these birds passing north over Lake Galilee at 400 feet above the Lake. On two occasions when Storks were passing up the Jordan Valley at about 400 feet, they would see a Neophron or Kite soaring in an air spiral; the Storks never failed to branch off and join in this natural assistance to gain height, and would then continue their journey at about 4000 feet above the Jordan Valley, but only some few feet above the surrounding hills.

*Crane.* Pyrenees. Observed passing over the Pyrenees at 1500 and 1800 feet, but in Bulgaria they were noted crossing the Rhodope Hills (Boetticher, J. f. O. 1919, p. 239) at no great height.

On a still October evening on the desert 40 miles east of Damascus I watched the autumn arrival of large "wedges" of Crane. They descended to a lake from a height I estimated at about 4000 feet, arriving from the north. With my glasses I could see party after party at many miles' distance, approaching the lake. Birds did not attempt to lose height till well over the lake.

*Quail.* Southern Palestine. Seen arriving at daylight on the coast near Rifa, passing over the sea just above



the water, many parties continuing their passage south over land only a few inches above the ground. Lynes also noted Quail arriving near Port Said and flying low.

*Stock Dove.* They travel on migration at about 100 feet on autumn passage over Orenburg. (Grote.)

Such is the all too scanty evidence, and it will be seen at a glance how little refers to nocturnal movements: but as evidence of nocturnal movement, we must accept the observation of birds arriving after a migratory flight, and the calling of migrating birds which is so frequently heard by night.

All evidence of the arrival of birds after a long migratory flight points to the fact that no excessive height is reached during flight. The Cranes at Damascus, and Quails and Hoopoe at Port Said and Raza, do not indicate excessive height.

As regards the calling of migrants by night, such noises, when heard on clear still evenings, must be accepted as evidence under normal conditions. Now the European Bee-eater is an excellent example, because it is an incessant caller when migrating; it travels by both day and night, and is common enough and of sufficiently wide distribution to give us ample opportunities of observation. I have observed daylight passage in East Africa, Baluchistan, Palestine, and in Egypt, and have always endeavoured to note the altitude of flight and accustom myself to the degree of intensity of the note at the various elevations. Results from such guess-work are necessarily unsatisfactory but constitute a guide.

I have never heard Bee-eaters passing without being able to locate them, though sometimes they could not be discovered *ab initio* without the aid of binoculars, and I doubt whether any such diurnal flight as observed by me extended to over 3000 feet. An argument may be advanced that others were passing out of sight and hearing; but I would mention that the Bee-eater's call carries far. I recently in Crete, when at an elevation of 6000 feet, heard a flying Raven croaking

loudly up in the skies as he was returning from the coast to Mount Ida. From where I was sitting I had a panoramic view of a large part of southern Crete, and the Raven was more or less level with me. It was some time before I could pick him up with my glasses, and he then settled in a tree some two miles from me. I see no reason why a flock of Bee-eaters should not be heard at well over that distance when flying overhead, but I very much doubt if they would be visible to the naked eye at over two miles, and even with glasses I doubt the possibility of picking them up. We know that sound travels better vertically down to the earth than horizontally along it. An aeroplane at 17,000 feet is distinctly audible, but would not be heard at  $3\frac{1}{2}$  miles horizontal distance. Now I never heard a Bee-eater call at night at a greater distance from the earth than by day, which induces me to believe that they do not pass at much over 3000 feet by either day or night. If, according to Gaetke's theory, they were passing at about 20,000 feet, they would be invisible and inaudible whether by day or night.

Many other instances could be quoted showing that on clear still nights—normal conditions—migratory flight is clearly audible from the earth's surface, which tends to prove that nocturnal migration is performed below 20,000 feet and probably not much above 3000 feet.

The thousands of birds which annually strike the lantern-glasses of lighthouses do not constitute evidence of the altitude of migratory flight, as this nearly always occurs under abnormal conditions—fog, mist, rain, etc.—when all migration descends to near the earth's surface or sea-level. I know of no instance of a migration "rush" at a lighthouse in clear weather.

The fact remains that migration "rushes" are rarely witnessed except at lighthouses when unsuitable weather conditions brings migrants down to a very low level, or when migration has been checked or "banked up" on account of fog, rain, or storm. Though frequently seen in detail, migration is but seldom witnessed in bulk. Masses of migrants may be met with in a certain district and on a

certain day, but how seldom one sees those hosts in movement by day or hears them passing by night.

I recently made some enquiries about the number of duck and quail which are annually slaughtered for the market in Egypt. Near Port Said alone over 600,000 Duck are killed yearly, and over three million Quail are exported annually from Egypt, and these colossal figures only represent a part of the total butcher's bill. Who sees these millions arrive or depart? Who ever hears or sees them moving. I have but one record—a wonderful experience—by an eye-witness, and that was of Duck passing north *en masse* near Port Said in the spring of 1920. From the description it was a sight that few are privileged to see.

So in this respect we must accept Gaetke's theory that invisible migration is the normal, but I cannot agree that migration takes place at such elevations as 20,000 feet. And the reason that normal migration is generally invisible can only be that most birds travel by night. This is confirmed by the fact that so little migratory movement has been observed from aeroplanes, when we realize that in north-eastern France, Palestine, Mesopotamia, and East Africa the air has been so thoroughly watched throughout several migratory seasons.

It is indeed tempting to assert that migratory movement proceeds above the possibility of normal observation from aeroplanes—say at 20,000 feet or over. But our evidence does not allow of this. In fact, the nearer we get to 20,000 feet, the scantier becomes our evidence. Omitting for the moment the American telescopic observations by moonlight, let us take all instances of birds observed in flight at 5000 feet or over, and we have :—

15	cases of	Lapwing,
4	„ „	Geese,
3	„ „	Crane,
2	„ „	Rooks,
2	„ „	Waders,
10	„ „	other birds ; or 36 cases in all.

Now of these the Birmingham Kestrel, the Mosul S

the Salisbury Rooks, and the Lammergeier were undoubtedly not migrating and need not be considered. Of the remainder, the highest seven recorded altitudes are 15,000, 12,000, 10,500, 10,000 (twice), 9,500, and 8,500 feet. Below 8000 feet observations become more frequent, whilst between 3000 and 5000 feet they are not uncommon. Now aerial observation in France and Palestine extended well above 8500 feet, and if mass migration did occur above that elevation, it could not fail to have been observed even on its outskirts. The very lack of evidence, where evidence should exist, convinces me that flight at over 5000 feet is abnormal whether by day or night.

Regarding the American telescopic observations across the face of the moon, I prefer to believe that Chapman recognized a Carolina Rail by moonlight at under half a mile than at about two miles distance. Though I do not for one moment wish to belittle these most interesting and instructive experiments, I feel that observations with such gigantic margins of estimation should be accepted with care until we get a large series to work on.

Before attempting to reach a final conclusion on this subject, it is necessary to take up the questions of (a) The effect of weather on the altitude of migratory flight; and (b) The use of sight by migratory birds.

(a) *The effect of weather on the altitude of migratory flight.*

Gaetke states that during both spring and autumn migrations without exception, all species approach in largest numbers to the earth's surface when very light south-easterly winds, accompanied by clear warm weather, happens to prevail for any length of time in the lower reaches of the atmosphere.

Sufficient has been written by students of migration to show that neither velocity nor the direction of the wind has much effect on the altitude of migratory flight. Herman, however (Aquila, i. p. 9), shows clearly that migratory flight is brought nearer the earth in bad weather—storms,

fog, mist, etc. (*cf.* also *Aquila*, x. p. 71), and this has been amply proved by recent observations. No student of migration can have failed to observe that in the height of a migratory passage, passage-migrants are not so much in evidence in clear and still, as in dull or rainy weather. The reason is obvious. Birds, as do our air pilots, like to see the earth, and descend in bad weather to a position where they can see it, or if the weather becomes too bad, flight is stopped altogether. I do not believe that weather has any other effect on the altitude of migration than this.

I frankly do not understand Gaetke's above-quoted statement, for a south-easterly wind in Heligoland would be a dry wind entailing clear weather, and with such weather conditions migratory flight is normal, the altitude of migratory flight not being brought nearer to the surface of the earth.

(b) *The use of sight by migratory birds.*

It is generally accepted that of all animal life, specialization of sight reaches its highest degree of development among birds. Lewis (*Emu*, xv. p. 217) considers birds to have an acuity of vision 100 times greater than that of human beings. The wonderful eyesight of Vultures, the vision which permits Cormorants to fish in muddy waters or a Kestrel to pick up small beetles when hovering at 200 feet or more, cannot fail to impress us. And I was recently still more impressed when sitting on the snows of Ida's summit in Crete. Out of the clouds rushed hundreds of Alpine Swifts which at once commenced feeding within a few feet of me. Their twists and turns denoted an abundance of food, and although some birds took insects within a few feet of me, I could detect no sign of insect life. On shooting one, I found the birds were catching a minute beetle scarcely so large as a pin's head. To do this when travelling at some 80 miles an hour, does indeed bear out Lewis's comparison of the acuity of vision as between men and birds.

I now wish to quote Dixon ('Migration of Birds') :—

“In no part of the world do any regular migration

routes cross seas too wide to be bridged by the eye of a bird flying at a sufficient altitude, and 5000 feet is considered sufficient altitude for all practical purposes ; but that birds do ascend to 25,000 feet is unquestionable."

Now calculating on the formula  $\sqrt{\frac{3 \cdot \text{V.I. in feet}}{2}}$  the

following are the horizontal distances in miles at which the horizon is visible from heights in feet. Of course, high ground showing above the horizon would be visible from a lower height, but it takes very high ground to appear above the horizon at 100 miles.

From	500 feet	.....	27 miles.
„	1000 „	.....	39 „
„	2000 „	.....	55 „
„	3000 „	.....	67 „
„	4000 „	.....	77 „
„	5000 „	.....	86 „
„	10,000 „	.....	122 „
„	20,000 „	.....	176 „
„	26,700 „	.....	200 „

I do not know on what Dixon bases his statement that birds unquestionably ascend to 25,000 feet. Nor in the first part of his statement under criticism has he considered the migrations of the Golden Plover of America during either their Atlantic or Pacific passages, nor that of our late-lamented Esquimaux Curlew, of *Urodynamis taitiensis* the long-tailed Cuckoo of New Zealand, or of certain of the Petrels. The least of these migrants would have to ascend to an altitude of over 70 miles in order to satisfy Dixon's theory, and the Golden Plover would be flying far outside the cushion of air which surrounds the earth.

But perhaps Dixon's interpretation of regular migration routes is narrowed to those arbitrary and largely imaginary lines which some naturalists have traced across the world, in the fond hope that birds will abide by them.

Just one word on long-distance visibility. The following

instances have come within my personal knowledge. I have seen :—

1. Mount Ida in Crete from a ship at .....	miles	110
2. The Peak of Teneriffe from a ship at .....		120
3. The Island of Rodriguez from Mauritius on clear days and from 1500 feet in the latter island. Distance .....		125
4. Kilimanjaro Mountain from Nairobi, visible on any clear day.		140
5. The snows of the Himalayas from Meerut on a December evening .....		150
6. Mount Kenya (17,000 feet) from the Mau Plateau (8000 feet) on a clear dawn .....		160
7. From an aeroplane at 7000 feet over Hebron on a clear still evening in April 1917, I clearly saw the Dead Sea, the Mediterranean, Mount Hermon, the Gulf of Akaba, and Mount Sinai .....		200

Add to this a bird's acuity of vision and the clear atmosphere which is attained at a little distance from the earth, and I can see no reason why a migrant in most parts of Europe or Asia should require a greater elevation than 5000 feet or so to pick up landmarks—if altitude is required for picking up landmarks.

I do not believe that birds crossing the wider reaches of the Mediterranean pick up Africa before they lose sight of Europe. If the lower-flying Passeres, Quail, Hoopoe, etc. can do without landmarks as a guide, why should not other birds?

And if altitude is not required for picking up landmarks, surely 5000 feet is sufficient for safety, for local orientation, locating feeding or resting grounds. Lucanus's assertion that perspective disappears at about 3300 feet may be true for northern Germany, but does not hold for mountainous country, where perspective is still good up to at least 7500 feet, especially with a slanting sun.

I must ask my readers to accept, for the purposes of this paper, my view that birds do not rely to any large extent on landmarks to guide them on migration. It is a question outside the scope of this paper, but which I hope to deal with at a near date. I need, therefore, only mention that at night no degree of acuity of vision will assist a bird to pick

up landmarks at over say 50 miles, unless such landmarks be the dividing line between the sea and land, or perhaps some snow-clad range. (The snows of Mount Kenya are visible by moonlight at over 60 miles distance.)

But I have seen Quail and Hoopoe at sea on autumn passage in the earliest hours of dawn, when land could not have been visible to them from their position almost touching the surface of the waters. I see no reason to suppose Quail and Hoopoe travel higher by night than by day, and if they do not require the assistance of landmarks by day, why should they require such aid by night?

In this connection, Cooke\*, in a very masterful essay, gives a curiously confused statement on this rather confusing subject. He says:—

“Sight undoubtedly does play a part in guiding the night journeys also. On clear nights, especially when the moon shines brightly, migrating birds fly high and the ear can scarcely distinguish their faint twitterings; if clouds overspread the heavens the flocks pass nearer the earth and their notes are much more audible; and on very dark nights the flutter of vibrant wings may be heard but a few feet overhead.”

How can sight play a part in guiding birds on night journeys when on dark nights birds fly but a few feet above the surface of the earth?

As regards an oft-voiced view that greater altitude makes flight easier for a bird, I can only quote the experience of our Royal Air Force, that as altitude increases, the machine has greater difficulty in maintaining its height and speed.

#### *Conclusions.*

A great deal more evidence of an accurate nature must be obtained before any definite facts can be ascertained, and the following conclusions must only be regarded as provisional.

1. Birds need not, for the purposes of migration, ascend much beyond 5000 feet above the level of the earth, nor indeed do they.

\* Bird Migration, U.S. Dept. Agricult. Bull. no. 185, 1915, p. 27.



2. Birds met with above 5000 feet are the exception and not the rule.
3. That nocturnal flight need not be higher than diurnal, and that, in fact, it is not.
4. That the bulk of migratory flight is conducted below 3000 feet whether by day or night.
5. That under normal conditions, different species travel at different altitudes, some very low and some invariably high, but that during abnormal weather conditions, all birds are apt to fly low.
6. That during migratory flight, birds prefer to descend to below cloud level, though this is not always the case. Exceptions probably occur when gaps occur in a cloud-bank, or where islands of land continue to be visible beyond or above the cloud area.

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XXXV.—*Obituary.*

CLAUDE G. FINCH-DAVIES.

WE learn with great regret of the sudden death of Lieut. Finch-Davies of the 1st South African Mounted Riflemen, which occurred at the Castle at Capetown on the 3rd of August last, and was due to a sudden attack of angina pectoris. He was only 46 years of age, and his death is a great loss to South African ornithology.

Mr. Davies in early life joined the Cape Mounted Rifles, and spent the early years of his service in Pondoland and East Griqualand. When the Union of South Africa was formed, his regiment became the South African Mounted Riflemen, and with it he saw a good deal of war service during the late war, obtaining his commission as a Lieutenant in 1915. His wife was a daughter of Capt. Finch of Capetown, and after his marriage in 1916 he assumed the additional name of Finch. His wife and three children survive him.

Lieut. Finch-Davies joined the South African Ornithologists' Union in 1907 and the B. O. U. in the following